MISSOURI MONTHLY VITAL STATISTICS

Provisional Statistics
From The

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Focus...Maternal Weight Change Between First & Second Pregnancies and Outcomes

Extremes in maternal weight status have been shown in past studies to adversely affect pregnancy outcomes in different ways. Underweight women are more likely to deliver low birth weight (<2500 grams) babies, which is the leading cause of infant mortality.[1-2] Overweight or obese mothers are more likely to have macrosomic (4500 grams or more) babies and develop such complications as diabetes, hypertension, and cephalopelvic disproportion, and are more likely to deliver by C-Section.[3-4] The current study examines maternal pre-pregnancy weight change between first and second pregnancies among 92,513 maternally linked first and second singleton pregnancies to Missouri residents from 1989 to 1997. This way we may see the effect of changing maternal weight status on pregnancy outcome.

The Missouri linked data set was developed by linking higher order live births and fetal deaths from 1989 to 1997 to lower order live births and fetal deaths using probabilistic linkage procedures. From this sib ship file 99,675 linked first- and second-order singleton pregnancies (live births and fetal deaths 20 weeks or more gestation) for Missouri resident women were extracted. This represented 88 percent of the attempted linkages in which the targeted first birth was a live birth. Valid maternal height and pre-pregnancy weight status was available for both pregnancies for 92,513 of these sib ships (92.8 percent). Most of those with missing height and weight are non-Missouri recordings, as surrounding states do not have these items on their birth certificates. Categories of pre-pregnancy weight changes between pregnancies were:

1. lost 10 pounds or more.
2. less than a 10-pound change.
3. 10 to 29 pound gain.
4. 30 or more pound gain.

Table 1 shows the relationship of selected maternal characteristics with weight change between pregnancies. Most of the women in the study experienced some type of weight gain, an average of 8 pounds. Approximately 28 percent gained 10 to 29 pounds and more than one in ten gained 30 or more pounds. Only 7.5 percent lost at least 10 pounds and over half (54.4 percent) gained or lost less than 10 pounds.

Weight status in the first pregnancy was strongly related to weight change between pregnancies. Weight status was defined by body mass index (bmi) or kilograms divided by meters squared. Obese (bmi>29.0) and overweight (bmi 26.1-29.0) women were most likely to gain 30 or more pounds between pregnancies. Nearly 20 percent (19.4 and 17.8 percent, respectively) gained 30 or more pounds compared to 5.2 percent of underweight women (bmi<19.8) and 9.3 percent of normal weight (bmi 19.8-26.0) women. Obese women were also most likely to lose weight between pregnancies as 17.8 percent lost 10 pounds

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Table 1
Maternal Weight Change Between 1st & 2nd Pregnancies by Selected Variables: Missouri 1989-1997
Percent Distribution by Row

Maternal Characteristics		*Maternal Weight Change Between Pregnancies (pounds)*			
	Births	*Lost 10+*	*<10 chnge*	*10-29 lbs*	*30 or more*
Underweight in 1st pregnancy (bmi<19.8)	19,010	2.3	68.2	24.4	5.2
Normal weight in 1st preg (bmi 19.8-26.0)	52,836	6.7	56.0	28.0	9.3
Overweight in 1st preg (bmi 26.1-29.0)	8,054	12.6	36.2	33.5	17.8
Obese in 1st preg (bmi>29.0)	10,192	17.8	33.1	29.7	19.4
Spacing between births					
<18 months	17,462	8.8	56.4	27.3	7.5
5 years or more	6,258	5.8	37.3	35.0	21.9
African-American	12,427	8.4	47.6	29.9	14.1
Non-African-American	80,086	7.4	55.4	27.6	9.7
Unmarried in 1st, married in 2nd	9,871	7.7	43.7	31.1	17.5
Married in 1st , not in 2nd	2,025	15.2	50.5	24.9	9.4
Unmarried in both pregnancies	20,481	10.0	49.2	27.8	13.0
Married in both pregnancies	60,070	6.4	58.0	27.5	8.2
Age <20 in 1st pregnancy	27,158	8.5	46.8	29.3	15.4
Age 30+ in 1st pregnancy	11,499	6.3	65.7	23.3	4.7
Education level <12	16,815	9.8	49.1	27.8	13.3
Education level 16+	21,930	5.6	66.6	23.2	4.6
WIC in 1st pregnancy	33,906	9.1	46.2	29.9	14.9
Food Stamps in 1st pregnancy	13,122	10.0	45.8	28.2	16.0
Medicaid in 1st pregnancy	32,069	9.3	46.4	29.1	15.2
Fetal or infant death in 1st pregnancy	663	7.7	50.7	32.1	9.5
Smoked in 1st preg, not in 2nd	3,042	9.3	47.3	29.5	13.9
Didn't smoke in 1st, smoked in 2nd	4,463	13.1	50.6	24.8	11.6
Smoked in both pregnancies	13,183	11.4	53.7	25.5	9.5
Weight gain in 1st pregnancy <15 lbs	4,242	23.6	51.2	18.5	6.7
Weight gain in 1st pregnancy 45+lbs.	16,383	4.2	33.8	37.6	24.4
Total	92,513	7.5	54.4	27.9	10.3
Total Births	92,513	6,934	50,277	25,794	9,508

bmi=body mass index=kilograms/(meters squared)

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or more compared to 6.7 percent of normal weight women. Obese women thus were most likely to have large weight fluctuations as only one-third changed their weight less than ten pounds between pregnancies compared to over two-thirds for underweight women and 56 percent for normal weight women.

Approximately 73 percent of those in the 30+ pounds weight gain moved into a higher weight status category in the second pregnancy than in the first. Another 20 percent were already in the obese category and became more obese. Of those who gained 10 to 29 pounds between pregnancies, 42 percent moved into a higher category. A similar percentage of those who lost 10 or more pounds (43 percent) moved into a lower weight status category in the second pregnancy. Only 13 percent of those changing less than 10 pounds between pregnancies changed weight status categories.

The variable most strongly correlated with weight change between first and second pregnancies was weight gain in the first pregnancy (Pearson correlation coefficient = 0.29). Among those who gained at least 45 pounds during the first pregnancy, nearly one-fourth (24.4 percent) gained at least 30 pounds in pre-pregnancy between pregnancies compared to just 6.7 percent who gained less than 15 pounds during the first pregnancy. Evidently those who gain an excess amount during pregnancy have a hard time losing it after delivering. Contrarily, of those who gained less than 15 pounds in the first pregnancy, 23.6 percent lost 10 pounds or more between pregnancies compared to 4.2 percent of those who gained at least 45 pounds.

As would be expected the length of time between first and second pregnancies was related to weight gain between pregnancies. The longer the time period the more likely a large weight gain occurred because women generally gain weight as they get older. About 22 percent of the pregnancies with spacing greater than five years resulted in a weight gain of 30 pounds or more. Among the other variables studied, being African American, unmarried, having less than 12 years of education, being on Food Stamps or under age 20 in the first pregnancy were all associated with a slightly higher weight loss or weight gain between pregnancies than the average. Smoking and divorcing between pregnancies was associated with a slightly higher rate of weight loss while marrying between pregnancies was associated with a higher rate of weight gain of 30 pounds or more.

Table 2 shows adjusted relative risks (RRs) for selected birth weight and perinatal and infant death categories in the second pregnancy by the maternal pre-pregnancy weight change categories outlined earlier, with the less than 10 pound change as the referent group. In general the more weight a woman gained between pregnancies, the lower her

Table 2
Relative Risks of Maternal Weight Change Between 1st and 2nd Pregancies on low birth weight (LBW <2500 g), small-for gestational age (SGA), macrosomia(>4499 g) and fetal and infant mortality by type in second pregnancy (with less than 10 lb. change as the referent group): Missouri 1989-1997

	LBW	SGA	Macro-somia	Fetal Death	Neonatal Death	Post-neonatal Death	Peri-natal Death	Infant Death	Fetal or Infant Death
Weight change									
Lost 10+ lbs.	1.13*	1.10*	1.16	1.16	0.91	1.25	1.05	1.10	1.13
10-29 lbs. Gain	0.73*	0.77*	1.49*	1.13	0.85	0.62*	1.00	0.73*	0.87
30+ lbs. Gain	0.69*	0.70*	2.29*	1.49*	1.11	0.81	1.31*	0.96	1.14

*95 percent confidence does not overlap one.
Note:Adjusted relative risks calculated using multivariate logistic regression with the following covariates: race, education, and age of mother marital status in each pregancy, smoking status in each pregnancy, spacing since last pregnancy, gender, Food Stamps, previous fetal or infant death and birth weight of first pregnancy.

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chances of having a low birth weight (LBW, < 2,500 grams) or small-for-gestational age (SGA) baby, and the greater her chances of having a macrosomic (>4,499 grams) baby. The adjusted RRs of babies of mothers gaining at least 30 pounds between first and second pregnancies compared with babies of mothers who changed less than 10 pounds was about 0.70 for LBW and SGA and 2.29 for macrosomia. Infants of mothers who lost 10 or more pounds between pregnancies had adjusted RRs slightly higher than 1.10 for LBW, SGA and macrosomia.

The patterns of weight change RRs on mortality are less clear than on LBW, SGA and macrosomia (See Table 2). Small numbers and probable weaker relationships between maternal weight and mortality than maternal weight and birth weight are the primary reasons for this. For those who gain at least 30 pounds between pregnancies, there is a statistically significant increase in fetal mortality (RR=1.49 compared with pregnancies of women changing less than 10 pounds between pregnancies). This also leads to elevated perinatal (fetal death or neonatal (death in first 27 days of life)) RR of 1.31. There is a reduced rate of post-neonatal death (ages 1-11 months) for those gaining 10-29 pounds (RR=0.62). This may be spurious as there is no apparent reason for this. Overall those who lost at least 10 pounds between pregnancies and those who gained at least 30 pounds had slight, but non-significant elevations in any fetal or infant death (RRs=1.13 and 1.14, respectively).

Table 3 shows the relationships between adjusted mean birth weights and maternal weight change between first and second pregnancies. In general, the greater the maternal weight-gain between pregnancies the greater the birth weight of the second infant when maternal weight for second pregnancy is not adjusted for. Those mothers who gained at least 30 pounds between pregnancies had second babies with an adjusted birth weight of 3,519 grams or 143 grams more than the referent group that had less than a 10 pound change in maternal weight and 166 grams more than the

Table 3
Adjusted birth weights(grams) by maternal weight change between 1st and 2nd pregnancies; adjusted and unadjusted for maternal prepregnancy weight in 2nd pregnancy

	Adjusted birth weight in 2nd pregnancy (not adj. for maternal weight in 2nd preg.)		Adjusted birth weight in 2nd pregnancy (adjusted for maternal weight in 2nd preg.)	
Weight change		Difference from referent group*		Difference from referent group*
Lost 10+ lbs.	3353	-23	3367	-38
<10 lb change	3376	0	3405	0
10-29 lbs. Gain	3459	73	3438	33
30+ lbs. Gain	3519	143	3412	7

Note:Adjusted relative risks calculated using multivariate logistic regression with the following covariates: race, education, and age of mother marital status in each pregnancy, smoking status in each pregnancy, spacing since last pregnancy, gender, WIC

*referent group had less than a 10 pound change in maternal prepregnancy weight between 1st and 2nd pregnancies.

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babies of mothers who lost at least 10 pounds between pregnancies. These differences largely reflected the differences in maternal pre-pregnancy weight in the second pregnancy. After adjustment for maternal weight in the second pregnancy, the difference in birth weight largely disappeared as the difference between the highest weight gain group and the referent group was reduced to 7 grams.

Table 4 shows how maternal weight change between pregnancies is related to several other obstetric and pediatric conditions and procedures. Those with the least maternal weight change generally have fewer complications of pregnancy and labor, while those in the extreme categories of weight loss or gain have the most complications. Conditions most related to large weight gain include diabetes, hypertension, meconium, dysfunctional labor, fetal distress and cephalopelvic disproportion. Many of these conditions, especially diabetes and hypertension, are also related to the excess fetal mortality among those who gain at least 30 pounds between pregnancies. High weight gain is also related to greater likelihood of induced

Table 4
Maternal Weight Change Between 1st and 2nd Pregnancies by Selected Obstetric and Pediatric Conditions and Procedures in the 2nd pregnancy
Percent Distribution by Column

	Maternal Weight Change Between Pregnancies (pounds)			
	Lost 10+	*<10 chnge*	*10-29 lbs*	*30 or more*
Any medical risk factor	20.8	17.9	19.9	25.2
Diabetes	1.9	1.5	2.3	3.7
Hydramnios/Oligohydramnios	1.7	1.1	1.3	1.8
Hypertension(pregnancy-induced)	2.2	1.6	3.0	5.2
Any complication of labor/delivery	28.2	26.6	28.2	31.2
Meconium	4.8	4.3	5.3	6.3
Premature rupture of membranes	2.4	2.1	2.1	2.4
Abruptio placenta	1.0	0.8	0.6	0.5
Precipitous labor	3.9	3.6	3.0	2.6
Prolonged labor	0.3	0.4	0.4	0.6
Dysfunctional labor	2.2	2.1	2.6	3.7
Cephalopelvic disproportion	1.7	1.9	2.1	3.0
Fetal distress	4.6	3.8	4.1	4.9
Any obstetrical procedure	96.1	96.7	96.8	96.9
Amniocentesis	2.3	2.1	2.0	2.5
Induced labor	17.4	17.4	19.7	22.7
Tocolysis	1.8	1.7	1.5	1.3
C-Section	18.8	16.9	20.1	24.7
VBAC*	30.6	31.6	27.2	22.4
Any abnormal condition of newborn	6.1	4.7	5.2	6.0
Hyaline membrane disease	0.9	0.7	0.7	1.0
Assisted ventilation	2.5	1.7	2.0	2.5
Any birth defect	1.5	1.3	1.2	1.5
Total Births	6,934	50,277	25,794	9,508

*Percentages use repeat C-Sections+ VBACs as the denominator.

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labor and C-Section deliveries. These conditions are also all related to obesity as excess weight gain between pregnancies frequently leads to obesity.

Conditions associated with weight loss include abruptio placenta, precipitous labor, fetal distress and assisted ventilation. These conditions are largely related to prematurity, and are also associated with underweight mothers.

In summary, gaining or losing large amounts of maternal weight between pregnancies has definite effects on the outcomes of the next pregnancies. Weight losses can increase the chances of delivering a LBW or SGA baby and having complications associated with prematurity. Excessive weight gains can lead to oversize infants and fetal deaths, multiple complications such as diabetes, hypertension, various labor complications and more obstetric procedures such as induced labor and C-Section delivery. As with most things in life, moderation is the best policy. Excessive weight gain during the first pregnancy should be avoided as this can lead to obesity. On the other hand, physicians should discuss with women in the underweight, overweight and obese weight status categories healthy weight control programs to try to move closer to the normal weight status category before their next pregnancy.

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Provisional Vital Statistics for July 2002

Live births increased in July as 7,398 Missouri babies were born compared with 6,588 one year earlier. However, cumulative births for the 7– and 12– month periods ending with July both decreased. For January-July, births decreased by 2.4 percent from 44,405 to 43,448.

Deaths increased for all three time periods shown below. For January-July, deaths increased by 6.2 percent from 32,618 to 34,640.

The **Natural increase** in July was 3,005 (7,398 births minus 4,393 deaths). With the corresponding decrease in births and increase in deaths, the natural increase for January-July was down by over one-quarter from 11,887 to 8,808.

Marriages and **Dissolutions of marriage** both decreased for all three time periods shown below. For the 12 months ending with July, the marriage to divorce ratio increased from 1.74 to 1.81.

Infant deaths increased for all three time periods shown below. For the 12 months ending with July, the infant death rate increased from 7.6 to 8.3 per 1,000 live births.

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Item	July				Jan.-Jul. cumulative				12 months ending with July				
	Number		Rate*		Number		Rate*		Number		Rate*		
	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2000	2001	2002
Live Births	6,588	7,398	12.9	15.4	44,505	43,448	13.6	13.2	76,179	74,472	13.8	13.6	13.2
Deaths	3,937	4,393	7.7	9.1	32,618	34,640	10.0	10.5	54,072	56,349	9.8	9.6	10.0
Natural increase	2,651	3,005	5.2	6.2	11,887	8,808	3.6	2.7	22,107	18,123	4.0	3.9	3.2
Marriages	3,913	3,827	7.7	8.0	24,292	23,512	7.4	7.1	42,388	41,306	8.0	7.5	7.3
Dissolutions	1,938	1,623	3.8	3.4	13,988	13,206	4.3	4.0	24,354	22,776	4.5	4.3	4.0
Infant deaths	40	41	4.2	3.4	375	392	8.4	9.0	579	621	7.7	7.6	8.3
Population base..... (in thousands)	...	...	5,630	5,665	...	...	5,630	5,665	...	...	5,575	5,616	5,651

* Rates for live births, deaths, natural increase, marriages and dissolutions are computed on the number per 1000 estimated population. The infant death rate is based on the number of infant deaths per 1000 live births. Rates are adjusted to account for varying lengths of monthly reporting periods.